Southwest Fisheries Center Administrative Report H-86-20

FISHERY STATISTICS OF THE WESTERN PACIFIC

VOLUME II

Territory of Guam (1979-84)

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PREFACE

In recent years there has been a greatly increased demand for data and information concerning marine fisheries. In 1981 the National Marine Fisheries Service's Southwest Fisheries Center started the Western Pacific Fishery Information Network (WPACFIN) to help Pacific island fishery agencies upgrade their data collecting, processing, and reporting capabilities to help meet these increased needs in the central and western Pacific area. Agencies participating in this program include: the National Marine Fisheries Service's Southwest Fisheries Center and its Honolulu Laboratory, and the Southwest Region and its Western Pacific Program Office, American Samoa's Office of Marine and Wildlife Resources, the Commonwealth of the Northern Mariana Islands' Division of Fish and Wildlife, Guam's Division of Aquatic and Wildlife Resources, Hawaii's Division of Aquatic Resources, and the Western Pacific Regional Fishery Management Council.

In 1982 these agencies formed a Fisheries Data Coordinating Committee (FDCC) and a FDCC Technical Subcommittee to help guide, coordinate, and monitor all of the many activities being undertaken in each agency to improve their systems. Since 1981, significant progress has been made by all participating agencies, particularly in the areas of upgrading data collecting and processing systems.

As a major step in improving and coordinating the data reporting and distributing systems of the agencies, in May 1985 the FDCC agreed to begin producing a combined document reporting each island's major fisheries statistics. Production of the document would be the responsibility of the FDCC Technical Subcommittee and would be coordinated by the WPACFIN program manager. Each agency would supply required data for inclusion in the report through established WPACFIN methods. The FDCC further agreed that the initial reports would contain summaries back to 1979 if the data were available.

This document is the second volume in the new series "Fishery Statistics of the Western Pacific" and contains summaries of commercial and creel survey fishery landings for Guam from 1979 through 1984. The first volume contained similar commercial landings summaries for American Samoa, the Commonwealth of the Northern Mariana Islands, and Hawaii. The next volume will contain 1985 statistics from all of these islands.

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INTRODUCTION

This report has been compiled by staffs of the Guam Division of Aquatic and Wildlife Resources (DAWR) and the Western Pacific Fishery Information Network (WPACFIN) of the National Marine Fisheries Service's (NMFS) Honolulu Laboratory in a cooperative and continuing effort to improve the availability and dissemination of fisheries information in the Pacific area. The creel survey data contained herein were collected, computerized, edited, and processed by DAWR staff, and supplied to NMFS on floppy disks in WPACFIN data base formats. The commercial landings data were collected, computerized, edited, and processed by the NMFS staff with the cooperation of DAWR and the major fish wholesalers on Guam. The tables and graphs in this document were prepared by WPACFIN staff at the Honolulu Laboratory. Summary reports and files were produced on the central WPACFIN computer using software developed specifically for this purpose. Graphs were produced using commercially available software.

PROGRESS

In 1981 when WPACFIN began assisting agencies make improvements in their data collecting and processing systems, only the State of Hawaii had computerized processing. By mid-1982 fisheries offices in American Samoa, Guam, and the Commonwealth of the Northern Mariana Islands (CNMI) all had implemented computerized processing on microcomputers supplied by WPACFIN. Since that time, these agencies have made many significant improvements to their systems and have established sound automated data processing systems. Most agencies, including DAWR, can now provide fishery statistics to WPACFIN within 45 days of the date of collection.

PRECAUTIONS

Data collecting systems vary greatly among Pacific island fishery agencies. Although much standardization has taken place and is continuing, there remain many unique aspects of each island's systems based on local needs and capabilities. When using summaries contained in this report, especially if comparing them to similar statistics reported from other islands in Volume I of this series, one should keep in mind the nature of the collection systems used to produce the statisitcs. For instance, Guam's creel survey summaries are based on expansions of data from fishermen interviews conducted 4-6 times per month, Guam's commercial landings

summaries are from voluntary submission of purchase receipts by the major fish wholesalers, Hawaii's summaries are based on mandatory monthly reporting by licensed commercial fishermen, CNMI's data are based on voluntary monthly reporting by fish buyers using government supplied invoices, and American Samoa's summaries are based on almost daily interviews of the major commercial fishermen. Each system has its advantages and disadvantages and the user should be aware of them when making comparisons or interpretations of the data.

The user should also be aware that species assemblages vary among island groups as do cultural preferences and principal fishing techniques. Population size is of particular importance when making interpretations of the relative value and importance of fisheries. To help the user make these value judgments, detailed explanations of the data collecting and processing systems were given in Volume I for American Samoa, CNMI, and Hawaii, and are given for Guam later in this document.

CONTENTS

This document is divided into three sections. The first is a narrative description of Guam and its fisheries including discussions of the DAWR and WPACFIN data collecting and processing systems. The second section contains summaries of commercial landings data supplied by several Guam wholesalers. Monthly and annual summaries of pounds landed, value, and average price per pound are reported by species or species groups along with graphs of some of the most important commercial species or species assemblages. The third section provides summary reports and graphs of estimated catch and effort statistics from surveys conducted by DAWR including offshore and inshore creel surveys as well as summary reports of the annual Marianas Fishing Derby.

Definitions

The graphs are of summary fishery statistics having particular interest or importance to agencies participating in WPACFIN. For purposes of graphical presentation of the data, several categories have been created that reflect the nature of the fisheries or data collecting systems. Categories used in the graphs include:

1. Fisheries Categories - These are combinations of commercial species of similar ecological types,

specifically, pelagic, bottom fish, reef fish, and "other." "Other" includes groups that generally traverse the other three categories, such as sharks and certain jacks, or are not typically included in these groups, such as mullet and milkfish.

2. Pelagic Management Unit Species (PMUS) - Defined in the Western Pacific Regional Fishery Management Council's Fishery Management Plan for pelagic species to include the billfishes, wahoo, mahimahi, and sharks.

3. Bottom Fish Management Unit Species (BMUS) - Defined as the species of initial importance in the Fishery Management Plan for bottom fish and seamount fisheries including the major deepwater snappers, groupers, emperors, and certain jacks.

4. Tunas - Predominantly skipjack and yellowfin tunas and also including species such as the white or dogtooth tuna, and kawakawa, but excluding wahoo.

5. Other Tunas - All tunas as defined above, but excluding skipjack and yellowfin tunas.

6. Billfish - Combination of all marlin, sailfish, spearfish, and swordfish species.

7. Catch By Method - As used in DAWR creel surveys, methods include trolling, bottom fishing, spear fishing with scuba, spear fishing with snorkel, longlining, ika-shibi, atulai jigging, and miscellaneous other unspecified methods. The graphs combine all methods except trolling and bottom fishing into a single method "Other."

Graphics

Four types of graphs are provided for the commercial landings data. Type I graphs present summary charts of the major species and species groups for each year. Type II graphs are seasonality plots for the major species or species groups showing average weight landed during each month for all years combined. Type III graphs plot annual summary statistics to help visualize the variability between years, and Type IV graphs plot the monthly landings of the major commercially important species from July 1979 through December 1984 to document the monthly fluctuations in catches over the whole time series.

I. Monthly graphs for each year's commercial data:

   A. Major fisheries categories
   B. Tunas, PMUS, and BMUS
   C. Wahoo, mahimahi, and billfish
   D. Skipjack, yellowfin, and other tunas

II. Plots of average monthly commercial landings for:

   A. Tunas, PMUS, and BMUS
   B. Wahoo and mahimahi
   C. Marlin, spearfish, and sailfish
   D. Skipjack, yellowfin, and other tunas
   E. BMUS, grouper, emperor

III. Graphs of annual summary statistics for:

   A. Major fisheries categories
   B. Total commercial landings - pounds and dollars
   C. Tunas, PMUS, and BMUS
   D. Wahoo, mahimahi, and billfish
   E. Skipjack, yellowfin, and other tunas

IV. Graphs of monthly commercial landings over the entire time series for the following important species:

   A. Wahoo
   B. Mahimahi
   C. Marlin (predominantly blue marlin)
   D. Sailfish
   E. Spearfish
   F. Skipjack tuna
   G. Yellowfin tuna
   H. Grouper
   I. Emperor

Three types of graphs are provided for the summarized creel survey data. Type I graphs present monthly catch and effort statistics for trolling, bottom fishing, and other methods combined. Type II graphs are seasonality plots for the major species showing the average estimated weight landed during each month for all years combined. Type III graphs are of summary annual statistics to demonstrate variability between years.

I. Monthly graphs of each year's survey data include:

A. Catch by method
B. Effort by method

II. Plots of average monthly landings for:

A. Wahoo and mahimahi
B. Blue marlin and sailfish
C. Skipjack and yellowfin tuna

III. Graphs of annual summary survey statistics for:

A. Catch by method
B. Effort by method
C. Landings of wahoo and mahimahi
D. Landings of blue marlin and sailfish
E. Landings of skipjack and yellowfin tuna

GUAM FISHERY STATISTICS 1979 THROUGH 1984

BACKGROUND

The Territory of Guam is the southernmost, largest, and most populous island in the Marianas Archipelago which stretches northward between long. 144.4' and 146'E from lat. 13.3' to 20.3'N. All of the islands in the chain north of Guam belong to the Commonwealth of the Northern Mariana Islands. Guam is located about 6,000 km (3,700 mi) west-southwest of Honolulu, 2,500 km (1,550 mi) south-southeast of Tokyo, and 2,600 km (1600 mi) east of Manila. Guam is about 48 km (30 mi) long, varies from 6 to 14 km (4 to 9 mi) wide, has an estimated land area of 554 km^2 (214 mi^2) and a population of about 120,000.

Fishing activities on Guam can be divided into the two basic categories of inshore and offshore fishing. Inshore fishing is typically conducted without the use of a boat and consists mostly of nearshore casting, netting, and spearfishing. Offshore fishing typically involves small boat, 1-2 day trolling and bottom fishing trips that usually originate from the three principal harbors located on the west coast and southern tip of the island. Of these three harbors, Apra Harbor is the largest, serves military and commercial shipping activities, and is considered one of the best natural harbors in the western Pacific. It ranks third among the harbors as points of origination for offshore fishing trips. Cocos Lagoon on Guam's southern tip is the second largest protected harbor and ranks second as a launching area for offshore fishing trips. The Agana Boat Basin, centrally located on the west coast of Guam in the capitol of Agana, is the smallest of the three harbors and is the busiest launching area for offshore fishing trips.

The Guam Department of Agriculture's Division of Aquatic and Wildlife Resources (DAWR) has been conducting inshore and offshore creel surveys since the early 1970's. Beginning in 1982, DAWR staff began modifying their data collecting and processing systems to improve estimates of catch and effort by improving sampling technique and by incorporating the use of microcomputers to expand the survey data. The WPACFIN supplied microcomputers and training and worked with DAWR staff and a contractor to redesign the sampling program. In 1982 WPACFIN also began working with local fish wholesalers to obtain information on the commercial landings of Guam. It is from these two sources, DAWR and wholesalers, that the original data for the statistics presented in this report have come.

DATA COLLECTING SYSTEMS

The Guam data collecting systems are divided into two distinctly different systems, one for collecting commercial landings information and one for collecting total landings information through creel surveys.

Commercial Landings

The fish entering the commercial market in Guam come from three sources, full-time commercial fishermen, part-time commercial fishermen, and subsistence or recreational fishermen who frequently sell portions of their catch. There are no licenses required to sell fish in Guam, nor are there any reporting requirements for those selling fish. Before 1979 there was no central place to sell fish. Hence, fishermen had to develop their own markets and peddle their own fish after each trip. In July 1979 the Guam Fishermen's Coop was established in Agana via some government funding. Subsequently, the Coop became the central distribution center for fresh local fish. In 1982 WPACFIN began working with the Coop to improve their invoicing system and obtain data on all fish purchases. A cooperative system was established whereby the Coop would use the forms and coding schemes designed by WPACFIN and would supply copies of all invoices to WPACFIN for entering into computer format. In return, WPACFIN would provide the Coop with document quality control and computer generated summary statistics to help the Coop improve its business. Through a contract with the Coop, all purchase data back to July 1979 were coded and computerized.

In late 1983 two other fish wholesalers began to operate in Guam. Working through DAWR, WPACFIN established similar data collecting and processing arrangements with the two new wholesalers, Michael Pohl Enterprises and Pacific Fish House (PFH). The DAWR became responsible for collecting, editing, and coding the data, and WPACFIN performed the computerization and reporting functions. It is through the voluntary cooperation of these three wholesalers that reporting on the commercial fisheries of Guam is possible. All tables and figures of commercial landings information included in this report are provided with the consent of these wholesalers. Although a few fishermen still peddle their catches themselves, the majority of the fresh fish entering the commercial market in Guam is purchased by one the these three main wholesalers. (NOTE: PFH terminated operation in 1984.)

Data collected on commercial forms include:

Date
Fisherman code
Number of fishermen
Hours fished
Area fished
Species caught
Number of pieces caught
Pounds caught
Price per pound

Creel Surveys

The DAWR has the responsibility to monitor and protect the wildlife and marine resources of Guam. To do this for the marine fisheries, they began conducting creel surveys in the early 1970's. By systematic, random interviewing of fishermen DAWR developed a means of estimating total catch and effort by fishing method for the inshore and offshore fisheries. Sampling methodologies were frequently modified in the early years to incorporate new information and insights gained during the surveys. Aerial surveys were conducted for several years to help improve estimates of percent coverage. By 1979 the basic survey methodology was fairly well established. All data processing was done by hand.

In the 1970's an annual fishing derby was organized on Guam by groups of local fishermen. This 3-day tournament soon became a highly successful event with much participation by local recreational and commercial fishermen. The DAWR began collecting census information on the Annual Marianas Fishing Derby activities as a means of obtaining additional catch and effort information. Although the significance of these data is minor compared to the creel surveys, summaries of derby results are included in this document as a point of interest.

In 1982 WPACFIN hired a contractor to work with DAWR staff to improve the statistical validity of the creel surveys and to establish mathematical algorithms to expand the sample data to estimate total catch and effort with confidence intervals. Consequently, DAWR further improved their sampling methodologies based on the contractor's recommendations, such as adding surveys to better estimate total participation. WPACFIN developed computer processing systems to automate the data handling and expansion activities. The system design is flexible enough to allow for continued improvements as

additional information, insight, and sometimes funding are gained.

It is beyond the scope of this document to trace the evolution and details of the sampling strategies used by DAWR. Because of the evolutionary nature of the surveys, offshore data collected before 1979 and inshore data collected before 1983 are not considered to be of high enough quality to report in this document. Although the sampling methodologies have varied some between years, most of the basic concepts and assumptions have remained the same. It is essential for the user to understand the basic sampling design and some of the assumptions made for the offshore and inshore surveys to facilitate proper interpretation of the resultant statistics.

The DAWR's fisherman interview surveys, also called creel surveys, are divided into two separate major surveys, inshore and offshore. Both are based on a systematic random sampling of the fisheries; field sampling and interviews are done on a specific number of randomly selected weekdays and weekend-holidays each month. Both surveys are stratified by weekday and weekend-holiday sampling, and are currently conducted on 4-6 days per month. Both include two subsurveys, one for counting and estimating total participation and one for actually interviewing fishermen for catch and effort information. Both are based on the assumptions that the information given by the fisherman during the interview is accurate and the fishermen from which interviews are obtained are representative of the entire fishing population.

Offshore Creel Survey

Interviewing of offshore fishermen is conducted at the Agana Boat Basin where the majority of boating activity originates and terminates. Concurrent with interviewing fishermen returning from trips at the boat basin, a participation survey is conducted to obtain counts of boating activity for the entire island. For estimating total participation for a survey day, unless contrary information is available, if a boat is "out," as evidenced by its trailer at a boat ramp or being missing from its normal berthing area, it is assumed to be fishing. A further assumption is made that the fishing activity and success rate of fishermen originating at the Agana Boat Basin are not statistically different from those of fishermen leaving from other areas on the island. The basic premise of the offshore sampling program is that the combined interviews collected on each survey day are sufficient to estimate the average catch and effort for each

method used during that day. Therefore, each survey day represents a measurement of the offshore fisheries. Data collected during the participation portion of the offshore creel survey are limited to boat count by launching area, whereas data collected during the fisherman interviews include the following:

* Date (year, month, day)
* Type day (weekday or weekend-holiday)
* Fishing method
* Interview time
  Area fished
  Boat number
* Number of fishermen
* Number of gear units
* Hours fished per gear
  Total count for all species combined
  Type total count
* Total weight for all species combined
  Type total weight
  Total number of species
  Type total number of species
Total count for each species
  Type count for each species
Total weight for each species
  Type total weight for each species
Species name (or species group)
  Length for an individual fish
  Type individual length
  Weight for an individual fish
  Type individual weight
  Bait used (up to three different types)
  Wind direction and speed
  Weather conditions
  Cloud cover
  Lunar day
  Percent of catch kept
  Percent of catch sold to the Coop
  Percent of catch sold elsewhere

It is not always possible for the interviewer to obtain information on all items listed. However, those marked with an asterisk (*) are essential to have a completed interview that can be used in the data expansion process for estimating total catch and effort. Those marked with a pound or number sign (#) are essential in making estimates of percent species composition of the catch. The "type" elements (e.g., "Type individual length") identify the kind of measurements, i.e., either actual, estimated, or calculated.

Inshore Creel Survey

Fielding the inshore creel survey is considerably more complex and troublesome than the offshore survey for several reasons. For instance, fishing activities originate from and occur over a large portion of the coastline and participation counts, especially fishermen interviews, are much more difficult to obtain. Additionally, inshore interviews may reflect only a portion of the actual fishing trip because the interview is frequently obtained before the fisherman is finished fishing for the day. This is done primarily because the interviewer must continue working farther down the coastline to obtain other interviews. Fisherman turnover rate during the sampling period is also a difficult factor for which to adjust. Tidal stage and moon phase also influence inshore fishing much more than offshore fishing.

Notwithstanding these problems, the basic design of the inshore survey is very similar to the offshore survey in that it has participation count and creel interview portions. Two of the significant differences between the inshore and offshore surveys are that the inshore participation counts are made by fishing method as well as by location, and a whole month's inshore interview information on catch and effort is combined to form averages for the month. Therefore, the daily measurement of the inshore fisheries is based on the island wide participation counts for a survey day by using monthly averages for the catch information. This modification of sampling design was required for DAWR to physically complete an inshore survey with limited manpower. It is possible to obtain participation counts for essentially the entire island during a single sample day, but it is not possible to obtain creel interviews for all methods for the entire island with the manpower available. Therefore, the surveyable portions of the coastline were divided into three regions to facilitate statistically sound sampling of fisherman. Information collected during the inshore participation survey includes:

* Date (year, month, day)
* Type day (weekday or weekend-holiday)
* Location fished
  Time sighted
* Method used
* Number of persons
* Number of gear units
  Reef zone fished
  Weather and water conditions
  Tidal stage

Information collected during the inshore fisherman interviews includes:

* Date (year, month, day)
* Type day (weekday or weekend-holiday)
* Fishing method
* Interview time
* Location
  Reef zone fished
* Number of fishermen
* Number of gear units
* Actual hours fished per gear
* Estimated trip time
  Total count for all species combined
  Type total count
* Total weight for all species combined
  Type total weight
  Total number of species
Total count for each species
  Type count for each species
Total weight for each species
  Type total weight for each species
Species name (or species group)
  Length for an individual fish
  Type individual length
  Weight for an individual fish
  Type individual weight
  Bait
  Wind direction
  Wind speed
  Weather conditions
  Cloud cover
  Surf
  Tidal stage
  Swell direction

As in the offshore survey, it is not always possible for the interviewer to obtain information on all items listed. Those marked with an asterisk (*) are essential in the data expansion process for estimating total catch and effort. Those marked with a pound or number sign (#) are essential in making estimates of percent species composition of the catch. The "type" elements (e.g., "Type individual length") identify the kind of measurements, i.e., either actual, estimated, or calculated.

DATA PROCESSING SYSTEMS

The Guam data processing systems are divided into two separate and distinctly different systems, one for processing the commercial landings data and one for processing the DAWR creel survey data.

Commercial Landings

The processing system for the commercial landings data collected from the wholesalers is fairly straight forward. A purchase receipt form is completed by the wholesaler each time fish are purchased from a fisherman. Catches are divided into categories for weighing by species or species group and, where practicable, number of pieces is recorded. Coding and initial quality control of the forms are done by Coop or DAWR personnel before they are shipped to WPACFIN for computer processing. Data are entered into a computer and loaded into central WPACFIN data bases where edit reports are generated and used to locate and correct any errors in the data base. Once all edits, verifications, and corrections have been made, summary reports are generated. Standard reports available include total monthly and annual landings by species, total landings by fisherman, and landings by fisherman by species. Receipt books are returned to the wholesalers along with summary reports for their use.

Creel Surveys

The processing systems for the creel surveys are much more complex and have varied more over the years than those for the commercial landings data. However, the summary reports provided in this document have all been generated using standard methodologies in place in 1986. Therefore, only the current methods are important to understand the statistics presented in this document and only those methods will be described. The user may obtain additional information from DAWR if desired.

The basic data handling and processing systems for the inshore and offshore surveys are the same. Data forms completed in the field during the participation and creel surveys are returned to the office and edited for completeness and legibility before the data are entered into structured computer data bases using commercially available data base management software. Edit and summary reports are produced to verify the quality of the data and any errors are corrected in

the data bases. Data bases are then translated into standard record formats for the data processing and expansion systems programmed by WPACFIN specifically for the offshore and inshore surveys. As data are converted into the Guam Offshore Expansion System (GOES) and the Guam Inshore Expansion System (GIES), additional error checks are made by the computer to make sure only valid information enters the expansion systems. Errors are flagged and printed to facilitate correction. The GOES and GIES are user friendly, menu driven systems that step the user through a series of processes that summarize creel survey and participation data to produce catch and effort expansion and species composition files and reports. Typically 1 month of data is processed at a time, although the system allows for processing broader time increments together to produce expansion and summary files based on larger accumulations of data.

Generally speaking, the expansion algorithms for the inshore and offshore surveys are very similar. Estimates of daily catch, effort, and participation are generated for each method surveyed during the participation and creel surveys. The GOES uses same day catch and effort averages to expand the participation counts, whereas the GIES uses monthly catch and effort averages to expand the participation counts for a given survey day. These daily estimates are considered measurements of the fisheries for that day. Average weekday and weekend-holiday estimates and their associated variances or confidence intervals are created from individual daily measurements. These are weighted by the number of each type of day in the month, or other timespan, and multiplied by proportionality constants to adjust for percent coverage to produce estimates of total catch, effort, and participation along with their confidence intervals. All steps in the expansion process are stratified by fishing method. The expansion systems produce several detailed summary reports and a summary expansion data file containing the final totals for all important catch and effort statistics. This summary expansion file is later used to produce the type of reports contained in this document.

Estimates of species composition of the expanded catch are obtained for each method by multiplying the calculated percent species composition of the surveyed catch by the expanded total catch. Percent species composition by fishing method is obtained from the sampled catch based on the average individual weight and the total number of individuals recorded for that species. The average size of each species is obtained by one of three methods, depending on the availability of data in the data base. If total weight and count information is available, the average size per

individual is calculated by dividing the total weight by the total count. If total weight and count information is not available but individual weight measurements for a species are available, the average size per individual is calculated by dividing the sum of all individual weights by the total number of individuals weighed. If neither of these methods can be used because no size information is available in the data base, the user is asked to input the average size for that species, and the input average size is multiplied by the total count for the species to estimate total sampled catch of that species. Therefore, percent species composition is calculated by dividing the estimated sampled species weight by the estimated total sampled weight of all species combined. The species composition programs produce summary reports for immediate use and summary data files for later use as input to reporting and summarizing software used to generate the types of reports contained in this document.

DATA REPORTING SYSTEMS

The Guam data reporting systems are divided into two separate systems, one for reporting on the commercial landings data and one for reporting the results of the creel survey.

Commercial Landings

After completing all editing and quality control activities for the commercial landings data, monthly and annual summary reports by species are generated. The commercial landings reports section of this document includes monthly and annual reports from July 1979 through December 1984. Each report contains information on the pounds, value, average price per pound, and number of recorded landings for each species or species group. The number of recorded landings ("RECORDS" in the tables) is a measurement of how many times each species was purchased regardless of its number or weight in the landing. This statistic is provided to give an indication of the frequency each species is reported. The POUNDS can be divided by the RECORDS to calculate the average weight of each landing. Each monthly report contains a subtotal for the sum of all species combined for that month, and the December report also includes the annual total. Annual reports contain the total landings for each species and the total recorded landings for all species for the calendar year.

Included with the commercial landings summary reports are graphs of some of the important statistics. The following grouping of species, species categories, and abbreviations are used in the tables and graphs as taken from Guam's commercial landings:

I. Pelagic Management Unit Species (PMUS)

Mahimahi (dolphinfish)
Marlin (probably all blue, but possibly striped or black)
Shortbill spearfish
Sailfish
Wahoo
Sharks

II. Bottom Fish Management Unit Species (BMUS)

Jacks (unclassified, but excluding bigeye scad)
Bottom fish (unclassified)
Ehu (red snapper)
Gindai (flower snapper)
Grouper
Kalekale (pink snapper)
Lehi (silverjaw snapper)
Onaga (red or longtail snapper)
Opakapaka (pink snapper)
Uku (gray snapper)
Emperorfish

III. Billfish

Marlin (probably all blue, but possibly striped or black)
Shortbill spearfish
Sailfish

IV. Tunas

Tunas (unclassified)
Skipjack tuna
Yellowfin tuna
Dogtooth or white tuna
Kawakawa

V. Other Tuna

All the above tunas excluding skipjack and yellowfin tunas.

VI. Fisheries Categories

A. Pelagic Species

All PMUS and tuna species plus the following:

Troll fish (unclassified)
Barracuda
Rainbow runner

B. Bottom Fish

Same as the BMUS

C. Reef Fish

Reef fish (unclassified)
Giant wrasse
Rabbitfish
Rudderfish
Squirrelfish
Parrotfish
Snapper
Surgeonfish
Unicornfish
Goatfish

D. Other

Miscellaneous (unclassified)
Bigeye scad
Mullet
Eels
Milkfish
Invertebrates (unclassified)
Crabs (unclassified)
Coconut crab
Lobster
Shrimp
Octopus
Squid
Seaweeds
Imported

Creel Surveys

Two general types of reports are included in this document from the DAWR creel surveys, catch and effort expansion reports and species composition reports. These reports were produced by using the expansion and species composition files created by the GOES and GIES systems as input to a series of utility programs developed by WPACFIN. The utility programs reorganize, format, and summarize data from the GOES and GIES files to improve the presentation of the data and reduce the amount of space required to report the important statistics. Two of the most significant of these space saving improvements are the combining of many species into species groups, usually to the family level, and the combining of lesser used fishing methods into a single category. The original offshore and inshore species composition files contained about 330 different species categories which were reduced into about 90 categories. For instance, 22 species of squirrelfish and 20 species of wrasse were reduced into just the 2 family groupings. All significant or important species maintained their individual identity. In the original offshore species composition files catches were reported for nine methods; however, only two methods, trolling and bottom fishing, were significant as they generally accounted for over 97% of the catch. Therefore, reports of offshore species compositon were reduced to just three method categories, trolling, bottom fishing, and other. Inshore species composition reports were reduced to totals only. Expansion reports for the inshore and offshore surveys include estimates of total catch and effort for each method recorded.

Monthly and annual catch and effort expansion reports and species composition reports are presented for the offshore creel surveys for 1979 through 1984. Some monthly reports are missing due to a lack of sampling; however, annual reports adjust for this by using averages from sampled months to estimate the catch, effort, and species composition for the months not sampled. Monthly expansion and species composition reports have matching totals for catch by method since the monthly species composition reports were based on the expansion files. Annual expansion and species composition reports also have identical totals because the species reports were generated from the annual expansion files. However, the totals on the annual reports will not equal those obtained by adding all of the monthly files together because the annual expansion reports were generated by re-expanding the entire year's data together, thereby increasing the sample size significantly, and it is hoped, improving the annual estimates

of percent species composition and of catch and effort and their associated coefficient of variation (CV). This also makes it possible to expand for months where sampling was insufficient or nonexistant. The annual species composition reports were created by calculating annual percentages of species composition by combining all sampling for the year and then multiplying these percentages by the annual expansion totals. This allows for estimation of percent species composition for unsampled months and greatly increases the sample size used to calculate the percentage. Annual expansion and species composition reports are presented for the inshore creel surveys for 1983 and 1984. Combined inshore and offshore species composition reports are presented for 1983 and 1984.

Computer generated numbers and all totals in the reports are subject to rounding error. All catches are reported in pounds and effort in hours, boat hours for the offshore survey and gear hours for the inshore survey. On the offshore expansion reports the boat counts by method will not add to the total boat count when the same boat was used for more than one fishing method on a single trip. In these cases, the boat is included in the count for each method used, but included only once in the total boat count. A coefficient of variation is included for each statistic reported in the offshore and inshore expansion reports. This statistic provides a measurement of the relative variation associated with the estimate preceding it and is calculated by dividing the standard error of the estimate by the estimate and multiplying by 100 and rounding to express the answer as a whole percentage. The larger the CV, the larger the relative variation in the data used to generate the estimate, and therefore the less precise the estimate. If an asterisk (*) follows a line, there were an insufficient number of samples collected for that method during that month to properly calculate the CV. There must be at least two weekday and two weekend-holiday samples for each method to properly compute a standard error and therefore properly compute the CV. If an asterisk is present and the CV is greater than zero (0), then there were enough samples on either the weekend days or the weekend-holiday days to compute a standard error for that type of day, but not for the other type of day. In this case the CV provided in the report is for the type of day where enough sample information was available to meet the minimum requirements for calculating CV. If an asterisk is present and the CV equals zero, then neither day had sufficient number of samples to calculate CV. It follows then, that any time an asterisk is present for any of the methods, the totals for the month are questionable.

On the inshore expansion reports, catch per unit effort (CPUE) is equal to the estimated catch divided by the gear hours of effort because CPUE is averaged over the entire timespan for which the expansion was run, a full year in this case. Inshore CPUE does not, therefore, have an associated CV. However, on the offshore expansion reports, average CPUE is calculated using the same type of algorithm used for other expansion elements and has an associated CV. This means that average monthly CPUE is calculated by using each of the average daily CPUE's, calculated by dividing the daily sampled catch by the daily sampled boat hours, as equally weighted measurements for each type day sampled and finding the average and variance of these measurements taking into account the number of weekday and weekend-holiday days in the month. The average monthly offshore CPUE could also be calculated by dividing the estimated monthly catch by the estimated monthly boat hours, but this would provide no indication of the variability of the CPUE and would also essentially weight the average CPUE by the level of participation.

Offshore species composition reports provide estimated landings and percent species composition for each species or species group for the two major offshore fishing methods, trolling and bottom fishing, a total for all other methods combined, and an overall total for all methods. The inshore and combined inshore and offshore species composition reports provide the statistics only for all methods combined.

The reports for the annual Marianas Fishing Derby include derby and species totals by day for a variety of catch and effort statistics. Seven major pelagic species are targeted during the derby including billfish (primarily blue marlin but also sailfish, spearfish, and black marlin), yellowfin tuna, skipjack tuna, mahimahi, wahoo, rainbow runner, and barracuda. Most effort is directed at marlin, wahoo, and yellowfin tuna because prizes for these categories are the best. Average catch per boat trip has ranged from 34 to 66 pounds and landings of marlin have ranged from 6 averaging 263 pounds each to 43 averaging 138 pounds each. This tournament continues to grow in popularity and is the biggest organized fishing event in Guam.

INTERPRETATION OF STATISTICS

The user is reminded again to pay heed to the precautions and assumptions identified earlier in this document when making interpretations of or inferences from data reported in

the tables and graphs. Remember also that neither the commercial landings summaries nor the creel summaries are based on enumeration of fishing activities, but on samples of those activities. Commercial landings reports are believed to include a high percentage of the actual commercial landings made on Guam. The creel survey expansion reports are based on surveys of the inshore and offshore fisheries conducted 4-6 times per month. One of the major factors in expanding the survey data into monthly and annual estimates is the use of proportionality constants to adjust for percent coverage of the surveys. The flexibility of the survey design allows for the refinement of these constants as additional information is gained on Guam's fishing activities. If the constants are improved upon, the basic survey data can be re-expanded to create better overall estimates. However, the variability and species compostion would not be expected to change since these statistics are strictly based on the actual survey information collected from the fishermen.

Following are a few additional pieces of information not provided elsewhere in this document that could help the user interpret and gain perspective for the reported statistics.

For the 6 years of offshore creel survey reports included in this document, over 230 individual species codes were used in the original data bases. Of these 230, only 6 had a combined total landings over 1% of the total landings. Of these 6, one was a bottom fish (red opercular emperorfish) with 1.8%, and 5 were pelagic species totalling over 84%. The pelagic species in ascending order of importance were blue marlin (7.3%), wahoo (11.8%), yellowfin tuna (15.2%), mahimahi (20.8%), and skipjack tuna (29.1%). The breakdown of catch by fishing method for the 6 years of offshore surveys in descending order of importance was trolling (87.6%), bottom fishing (9.9%), atuli (akule or bigeye scad) jigging (1.0%), spear fishing by scuba (>0.6%), spear fishing by snorkel (<0.6%), longlining (<0.2%), ika-shibi (<0.1%), and all others combined (0.1%).

The inshore landings for 1983 and 1984 were 55 and 44% of the offshore landings and 35 and 31% of the total landings for these years, respectively. If these statistics are representative of the true proportion the inshore landings are to the total landings, the user can make estimates of the total island wide landings for Guam for the 4 years for which inshore statistics are not available. For the inshore surveys there were 122 species identified in 1983 and 127 species in 1984. Of these, 14 had estimated landings of over 1% of the total inshore catch for 1983, and 18 for 1984.

The inshore creel surveys for 1983 and 1984 were conducted during the daytime. However, the inshore reefs of Guam are also heavily fished after dark. Therefore, beginning in October 1984 the DAWR began conducting nighttime surveys of inshore fishing activities as a means of improving their estimates of total inshore fishing. Future volumes of this series will report on these night surveys.